State of Louisiana
Department of Natural Resources
Coastal Restoration Division

Monitoring Plan

for

Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake

State Project Number BA-37
Priority Project List 11

August, 2005
Lafourche Parish

Prepared by:

Glen Curole, Monitoring Section (CRD)
LDNR/Coastal Restoration and Management

MONITORING PLAN

PROJECT NO. BA-37 LITTLE LAKE SHORELINE PROTECTION/DEDICATED DREDGING NEAR ROUND LAKE

Date: August 16, 2005

Project Description

The Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project is a shoreline protection, marsh creation, and marsh nourishment restoration project located in the southwestern portion of the Barataria Basin in Lafourche Parish, LA (figure 1). The project area consists of 1,374 acres (556 ha) of intermediate marsh and open water habitat found along the southern lake rim of Little and Round Lakes. The shoreline protection phase of this restoration project extends for 22,200 ft (6,767 m) from the eastern bank of the Superior Canal to the western bank of John the Fool Bayou along the southern shoreline of Little and Round Lakes (figure 2). The marsh creation and nourishment phase of the BA-37 project forms its eastern border with the western bank of John the Fool Bayou, its western border with the eastern bank of the Tennessee Gas Pipeline Canal, and its northern border with the southern Round Lake shoreline (figure 2). The Bayou L'Ours Ridge lies directly south of the project, and the Louisiana Offshore Oil Port's (LOOP) oil storage caverns and brine retention pond are situated southwest of the project (figure 2).

The Bayou L'Ours subdelta was formed during the Lafourche deltaic lobe period (Gagliano and Wicker 1989). During this time, Bayou Lafourche and its network of distributaries, which includes Bayou L'Ours, comprised the main channel of the Mississippi River. Nutrient rich sediments were deposited along the banks of these distributaries primarily through overbank flooding (Sasser and Evers 1995). As a result, a ridge network (natural levees) was established along these channels creating enclosed basins encircled by elevated ridges (Gagliano and Wicker 1989).

In the years since the creation of the Lafourche delta, the sediment and freshwater supply to the Bayou L'Ours subdelta has decreased considerably. The Mississippi River changed its course to form the Plaquemine and Balize deltaic lobes, a dam was placed at the junction of the Mississippi River and Bayou Lafourche in 1904, and the Mississippi River was channelized by the construction of artificial levees along its banks. In addition, Bayou L'Ours has become a relict distributary of Bayou Lafourche (Sasser and Evers 1995). Therefore, the hydrology of the Barataria Basin as well as the Bayou L'Ours subdelta has been altered by natural and anthropogenic changes in freshwater and sediment distributions.

The reduced freshwater and sediment supply has been a major influence in the formation of highly organic inland, freshwater and intermediate marshes surrounded by slowly subsiding ridges and lake rims composed of mineral sediment deposits (Gagliano and Wicker 1989; Sasser and Evers 1995). These impounded organic marshes formed a floating marsh mat (flotant) overlying a layer of peat and organic muck (Gagliano and Wicker 1989; Sasser and Evers 1995). Sediment-poor organic soils accrete vertically predominately through slow oxidation of decaying plant matter and vegetative growth (root elongation) (Nyman et al. 1993; Delaune et al. 1993).

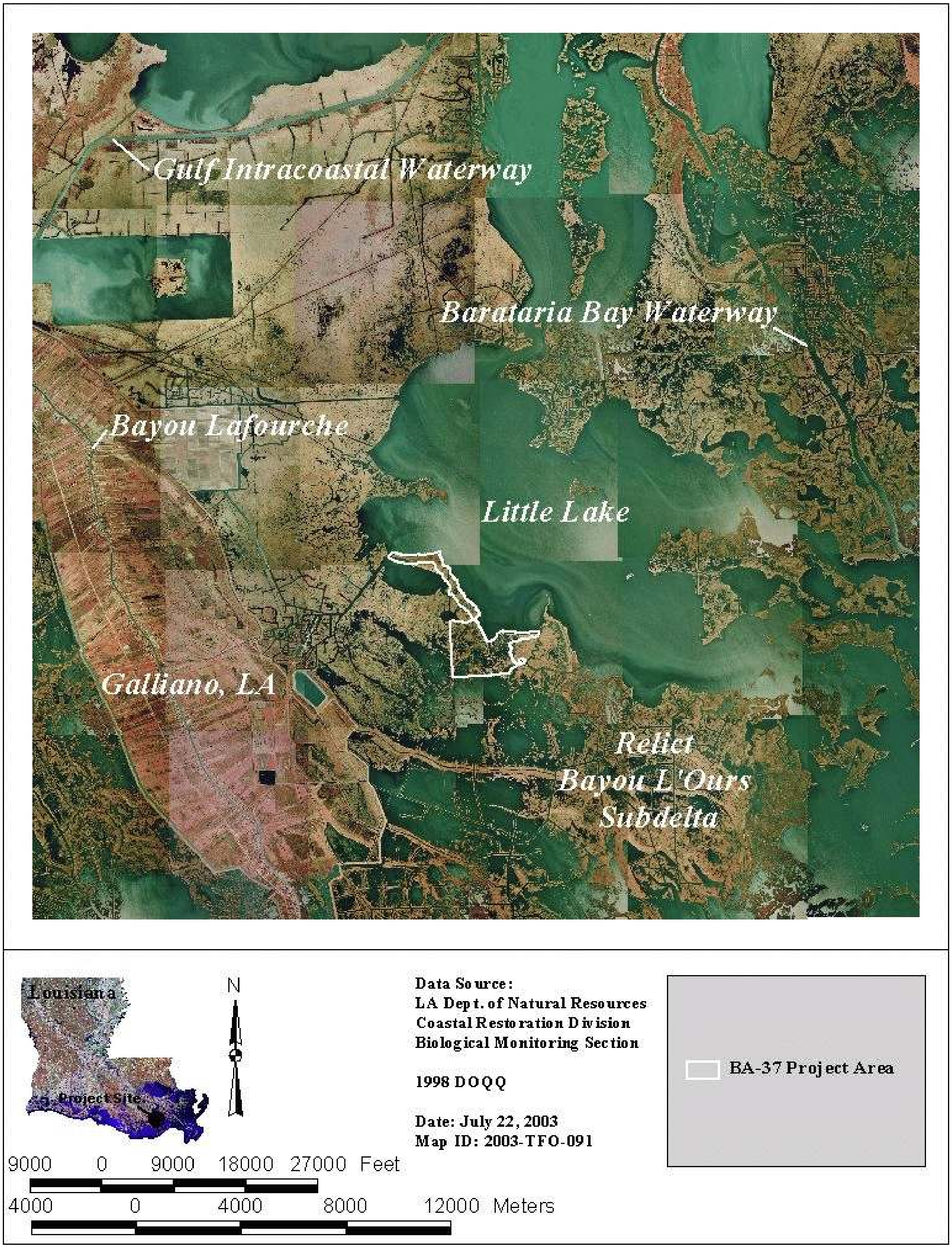


Figure 1. Location and vicinity of the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project.

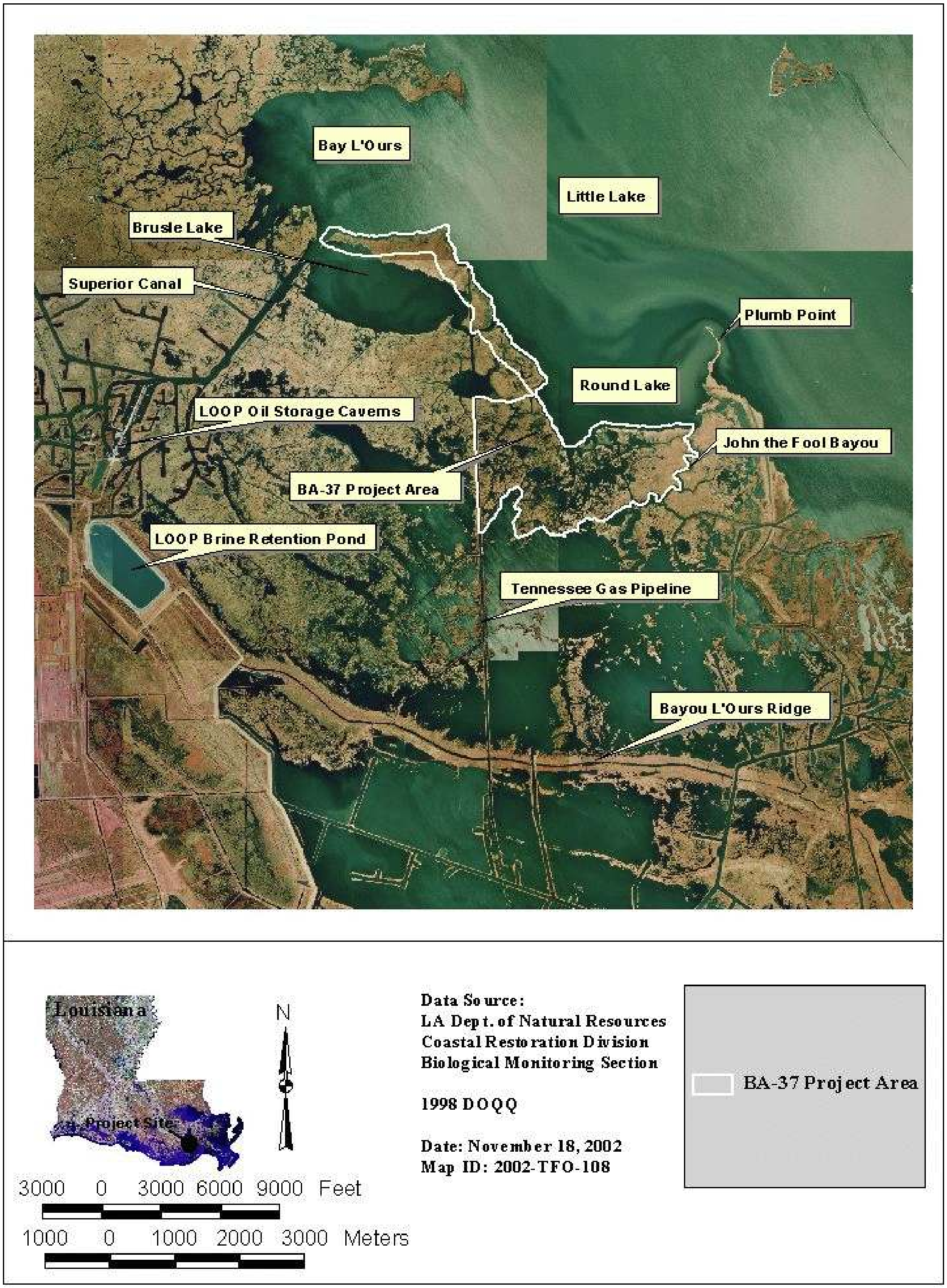


Figure 2. **Location of the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project area.**

The soils found along the Little and Round Lake rims are composed of a Lafitte-Clovelly association. These organic soils are generally found in very poorly drained brackish marshes (U.S. Soil Conservation Service 1984). Chabreck and Linscombe classified the project area as intermediate marsh in 1997, brackish to intermediate marsh in 1988, and brackish marsh in 1978. The area was also classified as brackish marsh by Chabreck et al. in 1968 and as floating three corner grass marsh by O'Neil in 1949. This area has been mapped as *Spartina patens* (marshhay cordgrass) and *Schoenoplectus americannus* (olney bulrush) brackish marsh (Sasser and Evers 1995; U.S. Soil Conservation Service 1984). *Eleocharis parvula* (dwarf spikerush), *Bacopa monnieri* (coastal waterhyssop), and *Ipomoea sagittata* (saltmarsh morningglory) have also been found to inhabit Lafitte-Clovelly association soils (U.S. Soil Conservation Service 1984). During an October 2002 field trip, *Juncus roemerianus* (needlegrass rush) was found to be quite abundant inside the project area; and small populations of *Spartina alterniflora* (saltmarsh cordgrass), *Baccharis halimifolia* (eastern baccharis), *Iva frutescens* (bigleaf sumpweed) and *Phragmites australis* (common reed) were observed in several locations inside the project area. In addition, *Ceratophyllum demersum* (coontail), a submerged aquatic species, was found in shallow ponds in the project area.

There was very little marsh degradation in the Bayou L'Ours basin until the advent of canal dredging for pipeline construction and oil field access in the 1940's (Gagliano and Wicker 1989). During the 1950's and 1960's, several rather deep access canals were allowed to breach the Bayou L'Ours ridge creating large gaps in the ridge which significantly altered the hydrology in the semi enclosed basin (Gagliano and Wicker 1989; Sasser and Evers 1995). These canals decreased the marsh surface elevations of the highly organic marsh mats, and introduced saltwater into a fresh and intermediate marsh environment. Tidal scouring of organic sediments, vegetation die-back, and subsidence resulted in extensive interior wetland loss (Gagliano and Wicker 1989; Sasser and Evers 1995). Land-loss data indicate that wetland area in the Bayou L'Ours basin decreased by 6,085 acres (2,434 ha) and total open water increased by 6,197 acres (2,509 ha) during the period from 1945 to 1989 (Sasser and Evers 1995). Specifically, the marshes between the Bayou L'Ours ridge and the Little and Round Lake rims showed considerable interior wetland loss from 1956 to 1978 (Sasser and Evers 1995). The marsh creation and nourishment area continued to experience large scale inland wetland loss from 1978 to 1990 (figure 3) (Barras et al. 1994). These marshes are reportedly subsiding at a rate of 0.021-0.035 ft/yr (0.006-0.011 m/yr) (Sweeney 2001). The Little and Round Lake rims have continually transgressed from 1956 to1990 and are reportedly eroding at a rate of 20-40 ft/yr (6-12 m/yr) (Sweeney 2001).

Project Goals and Strategies/Coast 2050 Strategies Addressed

Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) projects are reviewed prior to authorization of construction funds for compatibility of project goals and with those in Coast 2050, and for probability that proposed restoration strategies will accomplish those goals. Project goals and strategies are provided to the Louisiana Department of Natural Resources

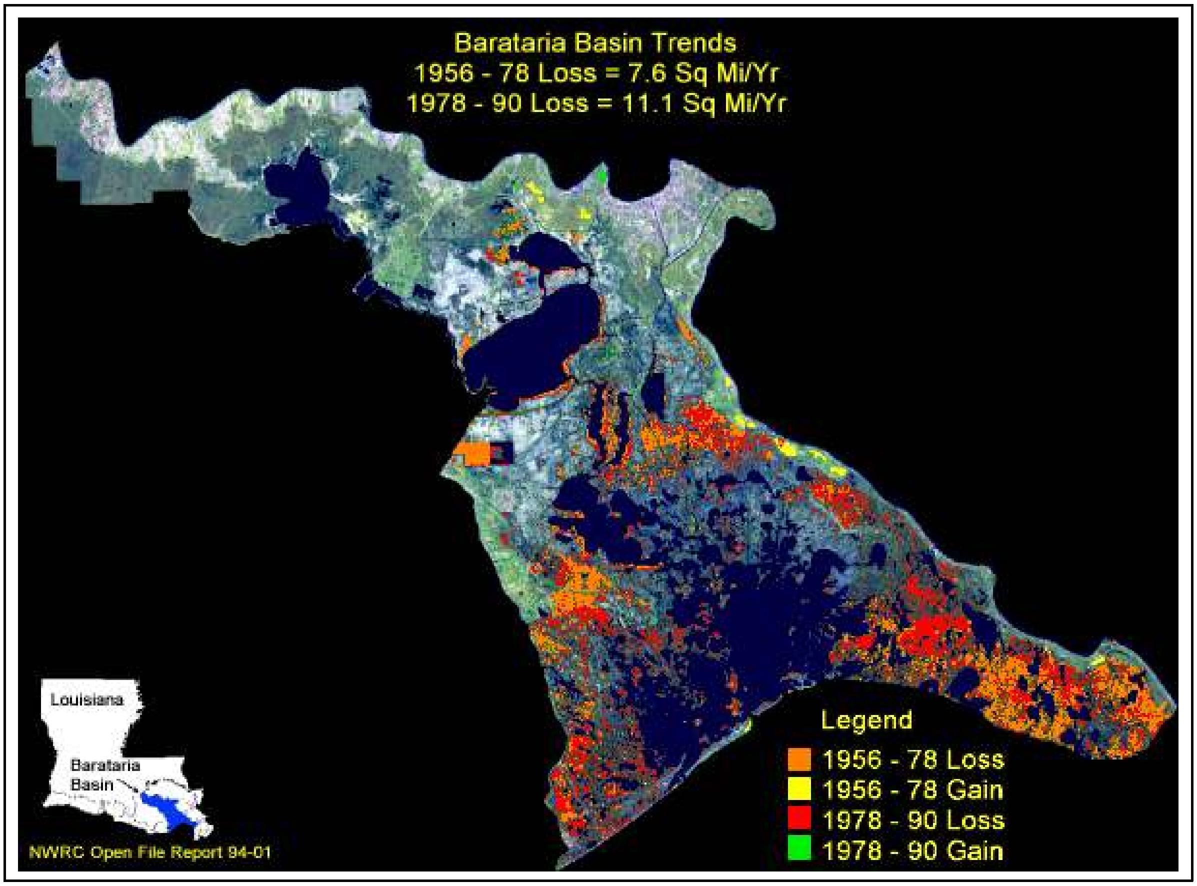


Figure 3. Land loss and land gain trends in the Barataria Basin form 1956 to 1978 and from 1978 to 1990 (Barras et al. 1994).

(LDNR) by the sponsoring federal agency through the environmental assessment (EA) and/or wetland value assessment (WVA). For the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project they were provided by the National Oceanic and Atmospheric Administration's (NOAA), National Marine Fisheries Service (NMFS)(2003).

Project Goals:

1. Reduce the marsh edge erosion rate along the Little and Round Lake shorelines.

2. Create approximately 551 acres (223 ha) of marsh at suitable elevations for growth and establishment of intermediate or brackish emergent vegetation.

3. Nourish approximately 406 acres (164 ha) of existing marsh to enhance the growth and establishment of intermediate or brackish emergent vegetation.

4. Maintain 799 acres (323 ha) of emergent marsh at the end of the 20 year project life.

Project Strategies:

1. Construct a 22,200 ft (6,767 m) foreshore rock dike along the -2 to -4 ft (-0.6 to -1.2 m) NAVD 88 Little and Round Lake shoreline contours to reduce the marsh edge erosion rate.

2. Place sediments dredged from Little Lake in confined open water disposal areas at an average elevation of 2.1 ± 0.3 ft (0.54 ± 0.09 m) NAVD 88 to create 551 acres (223 ha) of intermediate or brackish marsh.

3. Plant 50,000 *Spartina alterniflora* (saltmarsh cordgrass) plugs to stabilize marsh creation disposal areas and increase emergent marsh vegetation cover.

4. Place sediments dredged from Little Lake 6-12 in (15-31 cm) above the marsh surface to nourish 406 acres (164 ha) of existing marsh.

The construction of a foreshore rock dike will slow erosion along the southwestern Little Lake shoreline by damping wind-induced wave energy. The rock dike will be constructed to a final elevation of 3 ft (0.9 m) NAVD 88. The placement of dredged material and subsequent establishment of vegetation, in open water areas south of Round Lake is expected to result in the direct creation of marsh habitat at an elevation of 1 ft (0.3 m) NAVD 88 by year 5 post-construction (Belhadjali and Cowan 2003). The deteriorated marshes in the project area will be nourished through the placement of a 6-12 in (15-31 cm) layer of sediment atop the existing marsh. This will mimic the natural processes of vertical marsh accretion, which will introduce nutrients and decrease problems associated with prolonged flooding. The combination of strategies is expected to maintain a minimum target of 799 acres (323 ha) of emergent marsh by the end of the 20 year project life (Belhadjali and Cowan 2003).

Project Features

The Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project consist of two major features, a shoreline protection structure and marsh creation and nourishment area. The shoreline protection phase of this restoration project extends for 22,200 ft (6,767 m) from the eastern bank of the Superior Canal to the western bank of John the Fool Bayou along the southern shoreline of Little and Round Lakes (figures 2 and 4). The marsh creation and nourishment phase of the BA-37 project forms its eastern border with the western bank of John the Fool Bayou, its western border with the eastern bank of the Tennessee Gas Pipeline Canal, and its northern border with the southern Round Lake shoreline (figures 2 and 4).

A 22,200 ft (6,767 m) foreshore rock dike will be constructed along the -2 to -4 ft (-0.6 to -1.2 m) NAVD 88 contour (figure 5). To access these shallow areas close to the shoreline, an 80 ft

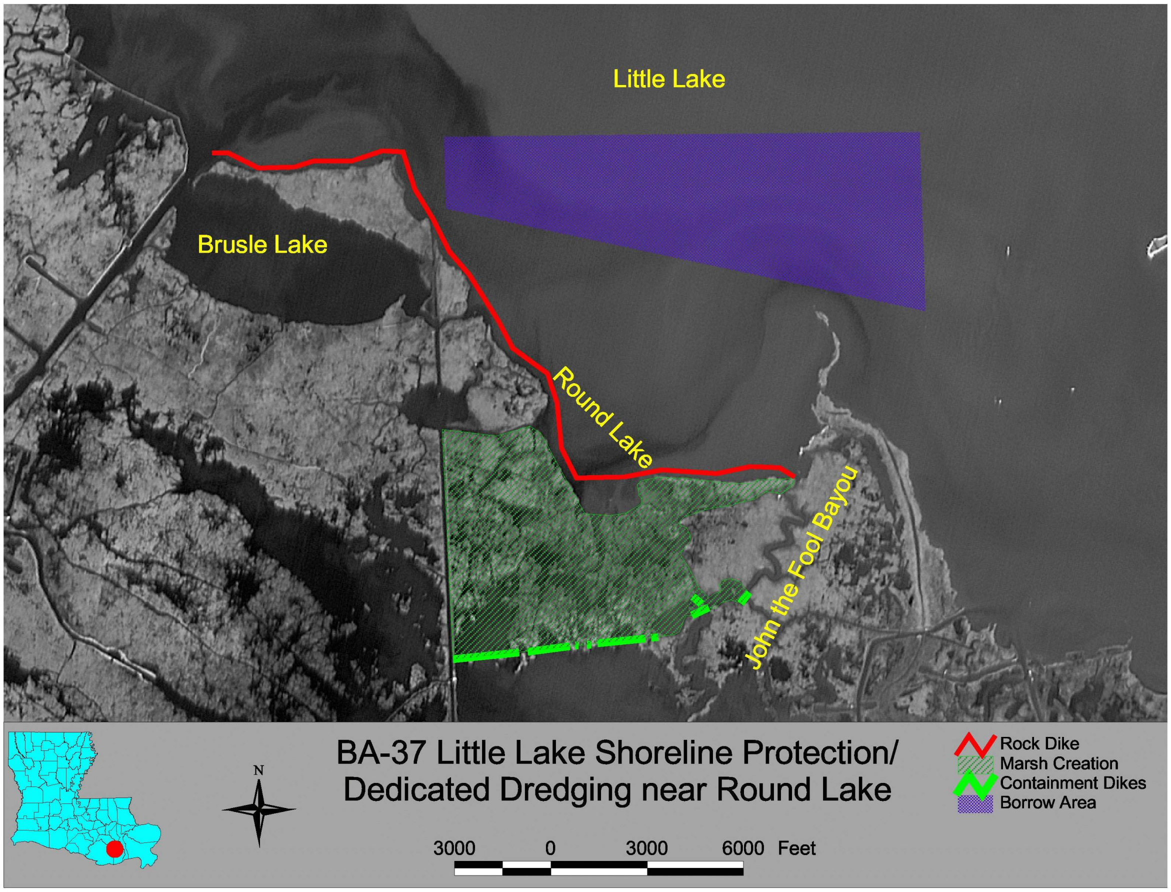
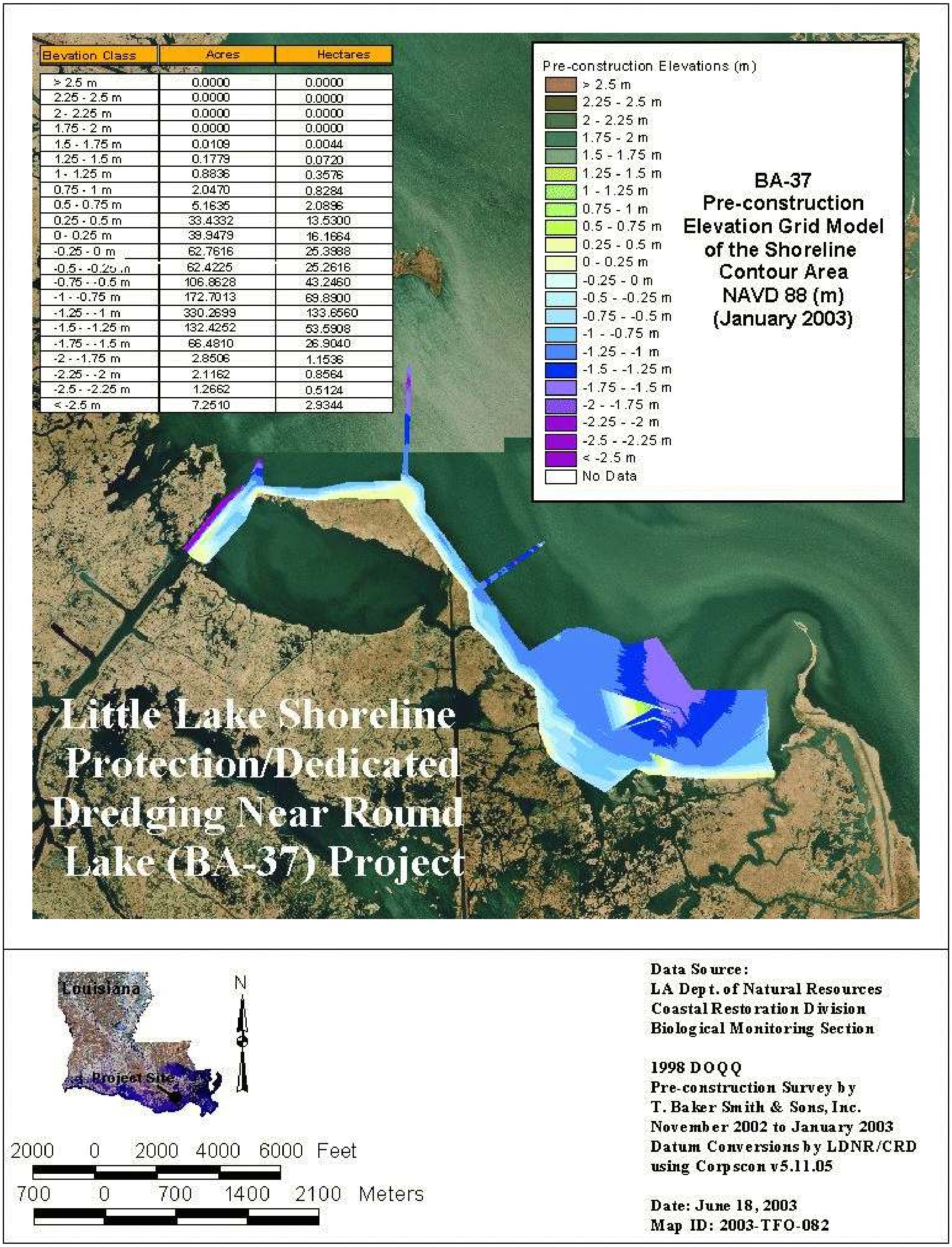


Figure 4. **Location of the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project features.**

(24 m) to 86 ft (26 m) floatation channel will be dredged to a depth of -5 ft (-1.5 m) NAVD 88 using a bucket dredge. The sediments dredged from this 42,695 ft (13,013 m) channel will be temporally placed north of the channel and permanently placed south of the channel behind the foreshore rock dike (figure 6). The dredge material permanently placed between the rock dike and the Little and Round Lake shorelines will be built to a maximum elevation of 2.1 ft (0.64 m) NAVD 88 and will have a minimum spacing of 10 ft (3 m) between both the rock dike and the shoreline (figure 7). Conversely, the sediments placed north of the rock dike will be built to a maximum elevation of 3.5 ft (1.1 m) NAVD 88 (figure 7) and will be used to backfill the floatation channel once construction activities are complete. Approximately, 376,786 yd^3 (288,073 m^3) of benthic sediments will be displaced to create the floatation channel.

The 22,200 ft (6767 m) foreshore rock dike will be constructed using 250 lbs (113 kg) class rocks that will be placed on top of a geotextile foundation (figure 7). This dike will be built to a 2.5 ft (0.76 m) NAVD 88 elevation and have an 3.5 ft (1.1 m) wide crown (figures 7 and 8). The base



Elevation Class	Acres	Hectares
> 2.5 m	0.0000	0.0000
2.25 - 2.5 m	0.0000	0.0000
2 - 2.25 m	0.0000	0.0000
1.75 - 2 m	0.0000	0.0000
1.5 - 1.75 m	0.0109	0.0044
1.25 - 1.5 m	0.1779	0.0720
1 - 1.25 m	0.8836	0.3576
0.75 - 1 m	2.0470	0.8284
0.5 - 0.75 m	5.1635	2.0896
0.25 - 0.5 m	33.4332	13.5300
0 - 0.25 m	39.9479	16.1664
-0.25 - 0 m	62.7616	25.3988
-0.5 - -0.25 m	62.4225	25.2616
-0.75 - -0.5 m	106.8628	43.2460
-1 - -0.75 m	172.7013	69.8900
-1.25 - -1 m	330.2699	133.6560
-1.5 - -1.25 m	132.4252	53.5908
-1.75 - -1.5 m	66.4810	26.9040
-2 - -1.75 m	2.8506	1.1536
-2.25 - -2 m	2.1162	0.8564
-2.5 - -2.25 m	1.2662	0.5124
< -2.5 m	7.2510	2.9344

Figure 5. Pre-construction elevations in the shoreline contour area at the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project.

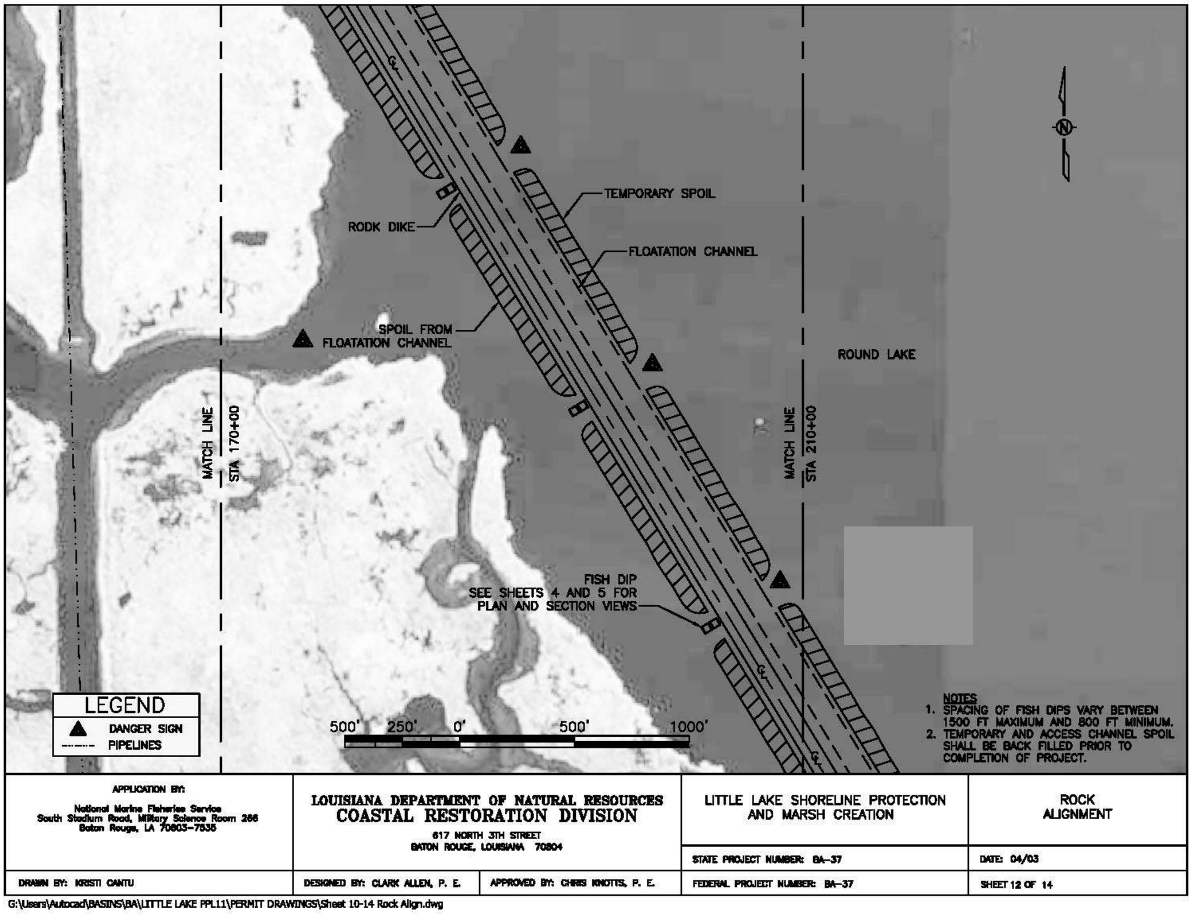


Figure 6. **Aerial view of a 3,000 to 4,000 ft (914 to 1,219 m) segment of the foreshore rock dike at the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project.**

of the rock structure will be 30-42 ft (9-13 m) wide depending on the shoreline contour and will be at least 40 ft (12 m) from the edge of the floatation channel. The rock dike will have side slopes of 4H:1V on the lake side and 2H:1V on the shoreline side (figures 7 and 8). Although the 22,200 ft (6,767 m) foreshore rock dike will be constructed along the -2 to -4 ft (-0.6 to -1.2 m) NAVD 88 shoreline contour, the rock dike will be primarily built along the -2 ft (-0.6 m) NAVD 88 contour (figures 4 and 5) and will be constructed along lower contours only when necessary. Approximately, 143,941 tons (135,811,000 kg) of 250 lbs (113 kg) class rocks will be used to build this 22,200 ft (6,767 m) structure.

Fish dips (breaches in the rock structure) will be installed in the foreshore rock dike every 1,000 to1,500 ft (305 to 457 m) for fisheries access (figures 6 and 8). Each fish dip will consist of a 20 ft (6 m) breach in the foreshore rock dike (figures 7 and 8). The 20 ft (6 m) breaches in the foreshore rock dike will be capped with a ± 2 ft (± 0.6 m) thick layer of rock installed flush with the bottom to prevent tidal scouring of sediments (figure 7 and 8). These subaqueous rock layers

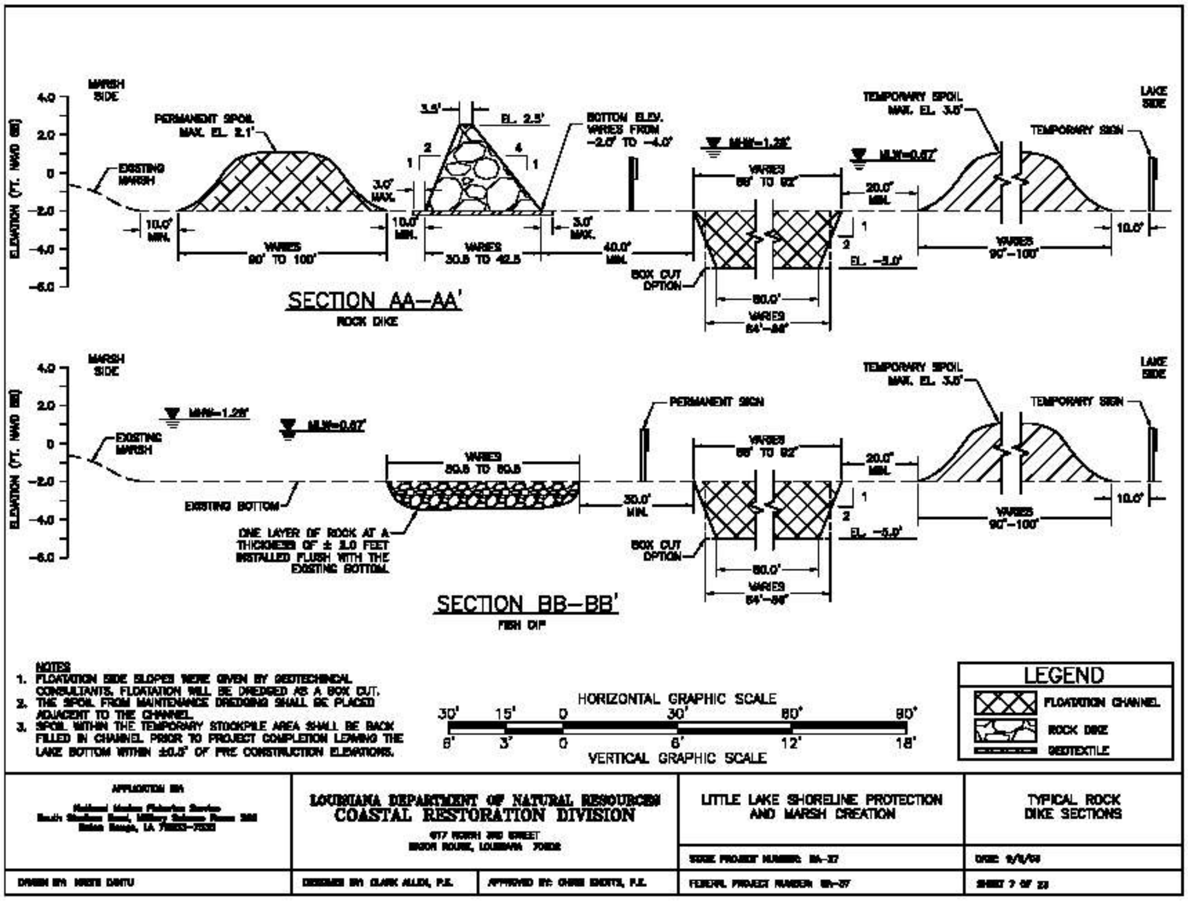


Figure 7. **Cross sectional views of typical foreshore rock dike (top) and fish dip rock dike (bottom) sections at the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project.**

will be extended an additional 10 ft (3 m) north and south of the foreshore rock dike and will be 40 ft (12 m) wide outside of the 20 ft (6 m) breach (figure 8). In addition, a 20 ft (6 m) gap will be placed between the subaqueous rock layer and the spoil areas created with sediments from the floatation channel (figures 7 and 8).

Eustis Engineering Company, Inc.(2003) recently (November 2002) investigated the stratigraphy and analyzed the stability of the subsoils along the shoreline contour of the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project. The overlying layer of benthic sediments (the mudline) consisted of approximately 6-12 in (15-30 cm) of black and brown humic material and an extremely soft to very soft sandy clay. The remaining subsurface media [20 ft (6m) borings)] was composed of extremely soft to very soft clay, silty clay, and sandy clay profiles. Eustis Engineering Company, Inc. (2003) estimated that the center of the foreshore rock dike will settle between 8-10 in (20-25 cm) over the 20 yr life of the project while the toe of the

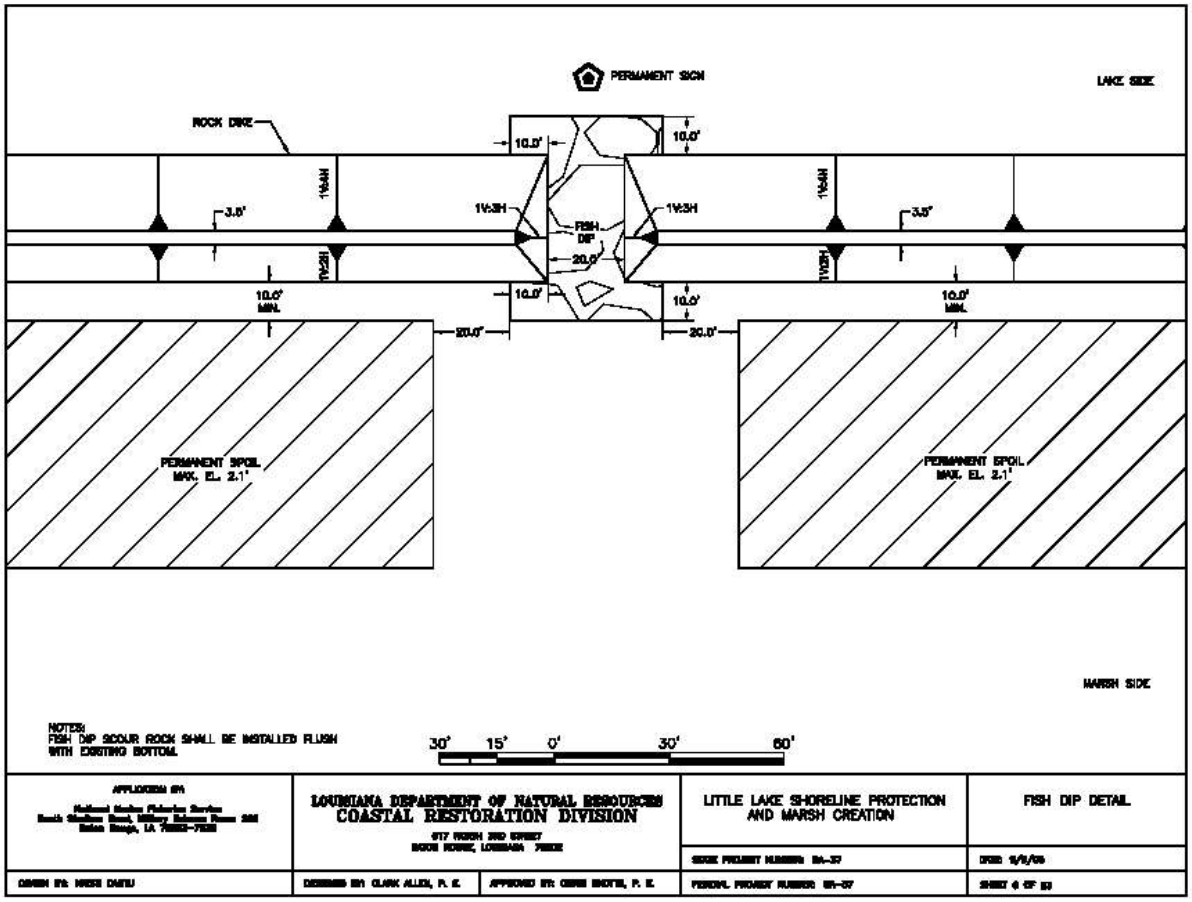


Figure 8. **Aerial view depicting a typical fish dip rock dike segment at the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project.**

dike is expected to settle around 2 in (5 cm) during this period. Ultimately, the settlement of the centerline of the dike should approach between 22-28 in (56-71cm), and the toe of the dike should experience between 4-5 in (10-13 cm) of settlement in these subsoils (Eustis 2003). A total of 24 settlement plates will be installed to record the settlement of the foreshore rock dike over time.

The marsh creation and nourishment phase of this project will consist of three project features: containment dikes, marsh creation in open water areas, and marsh nourishment over existing marsh. Several earthen containment dikes will be placed along 6,944 ft (2,117 m) of the southern border of the marsh creation and nourishment area (figure 4 and 9). These structures will be built to an elevation of 3.5 ft (1.1 m) NAVD 88, have an 8 ft (2.4 m) crown, and a 3H:1V slope on each side. The containment dikes will be built on top of a geotextile foundation and will be constructed using 18,261 yd^3 (13,961 m^3) of sediments bucket dredged from the marsh creation and nourishment area. The borrow area for the containment dikes will be dredged to a depth not

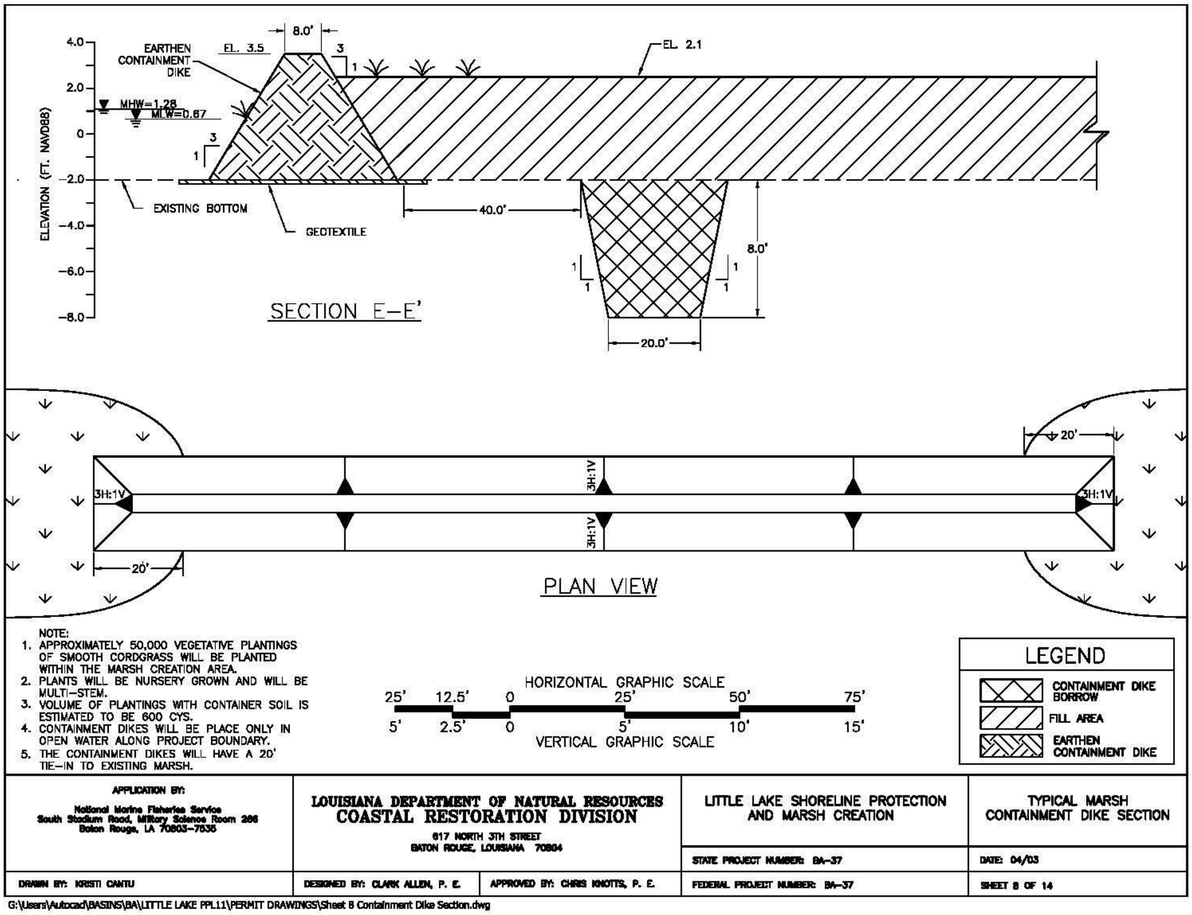


Figure 9. **Cross sectional (top) and aerial views (bottom) of a section of the earthen containment dike in the marsh creation and nourishment area at the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project.**

to exceed -8 ft (-2.4 m) NAVD 88, will be 20 ft (6 m) wide, and will be located approximately 40 ft (12 m) from the toe of the earthen structures (figure 9). These borrow areas will filled in during the marsh creation phase of the project.

Once construction of the containment dikes are complete, marsh creation activities will be initiated by dredging sediments from the 1,317 acre (533 ha) borrow area (figure 4). Sediments will be dredged to a maximum depth of -15 ft (-4.6 m) NAVD 88. Since the average depth to Little Lake's benthic layer in the borrow area is -4.46 ± 1.15 ft (-1.36 ± 0.35 m) NAVD 88 (figure 10), an approximate10 ft (3 m) deep layer of benthic sediments could be removed from portions of the borrow area. The benthic and subsurface media in Little Lake's borrow area consists of extremely soft to soft clay, sandy clay, and silty clay profiles (Eustis Engineering Company, Inc. 2003). An estimated 2,569,517 yd^3 (1,964,537 m^3) of benthic sediments will be removed from the 1,317 acre (533 ha) borrow area.

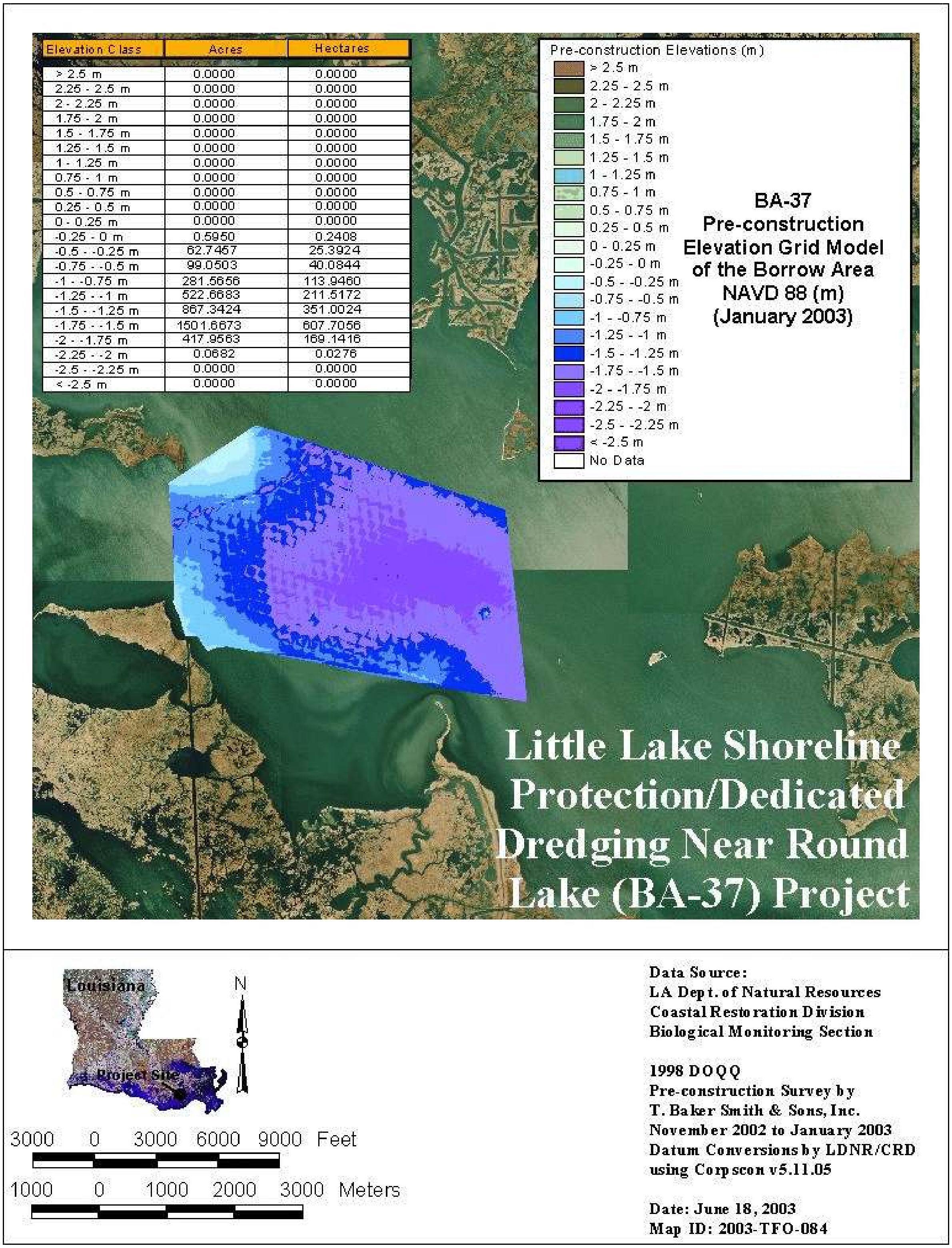


Figure 10. Pre-construction elevations in the borrow area at the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project.

The sediments dredged from Little Lake will be pumped into the marsh creation and nourishment disposal area. The stratigraphy of the existing marshes in the disposal area begins with a 7-12 ft (2-3.6 m) layer of extremely soft to very soft brown, black, and gray humus, organic clay and clay. Beneath this organic horizon lies very soft gray clay, very loose to loose gray sandy silt, and very loose to loose gray silty sand profiles (Eustis 2003). Open water areas in the disposal area will be filled to a maximum elevation of 2.4 ft (0.7 m) NAVD 88 to create new marsh (figure 9). The average elevation in the open water areas is -0.93 ± 0.78 ft (-0.28 ± 0.24 m) NAVD 88 (figure 11). Therefore, an average of 3 ft (0.9 m) of dredge material will be required to attain the target elevation of 2.1 ± 0.3 ft (0.64 ± 0.09 m) NAVD 88. Existing marshes in the disposal area will be nourished with the addition of 6-12 in (15-31 cm) layer of Little Lake sediments. Since the average marsh elevation in the disposal area is 0.94 ± 0.48 ft (0.29 ± 0.14 m) NAVD 88 (figure 11), nourishment will elevate the existing marshes to 2.1 ± 0.3 ft (0.64 ± 0.09 m) NAVD 88, the target elevation. Approximately, 2,569,517 yd^3 (1,964,537 m^3) of dredged material will be used to create 551 acres (223 ha) of marsh in open water areas and nourish 406 acres (164 ha) of existing marsh. Following consolidation, the disposal area is anticipated to have a final elevation of between 1.6-2.2 ft (0.5-0.7 m) NAVD 88 (Eustis Engineering Company, Inc. 2003).

To stabilize marsh creation disposal areas and increase emergent marsh vegetation cover, 50,000 4 in (10 cm), multi-stem *S. alterniflora* plugs will be planted (figure 12). 5,000 of these plugs will be planted on the slopes of the containment dikes once construction is complete. The remaining 45,000 plugs will be planted in the marsh creation and nourishment area as soon as the dredged sediments have consolidated (figure 12).

Monitoring Goals

Priorities:

Pursuant with the CWPPRA Task Force decision on April 16, 2003, no project specific monitoring will occur on CWPPRA projects that have not received phase II funding by April 16, 2003. These projects will be monitored using the CRMS wetland network of randomly placed wetland monitoring stations. However, none of the 700 CRMS wetland stations fall within the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project area or its immediate vicinity. Therefore, only the basin-level satellite imagery variable of the CRMS wetland methodology will be employed to evaluate the ability of the project features to effectively enhance and sustain the project area marshes as outlined in the project goals.

Specific monitoring Goals:

1. Evaluate land/water ratios in the project area.

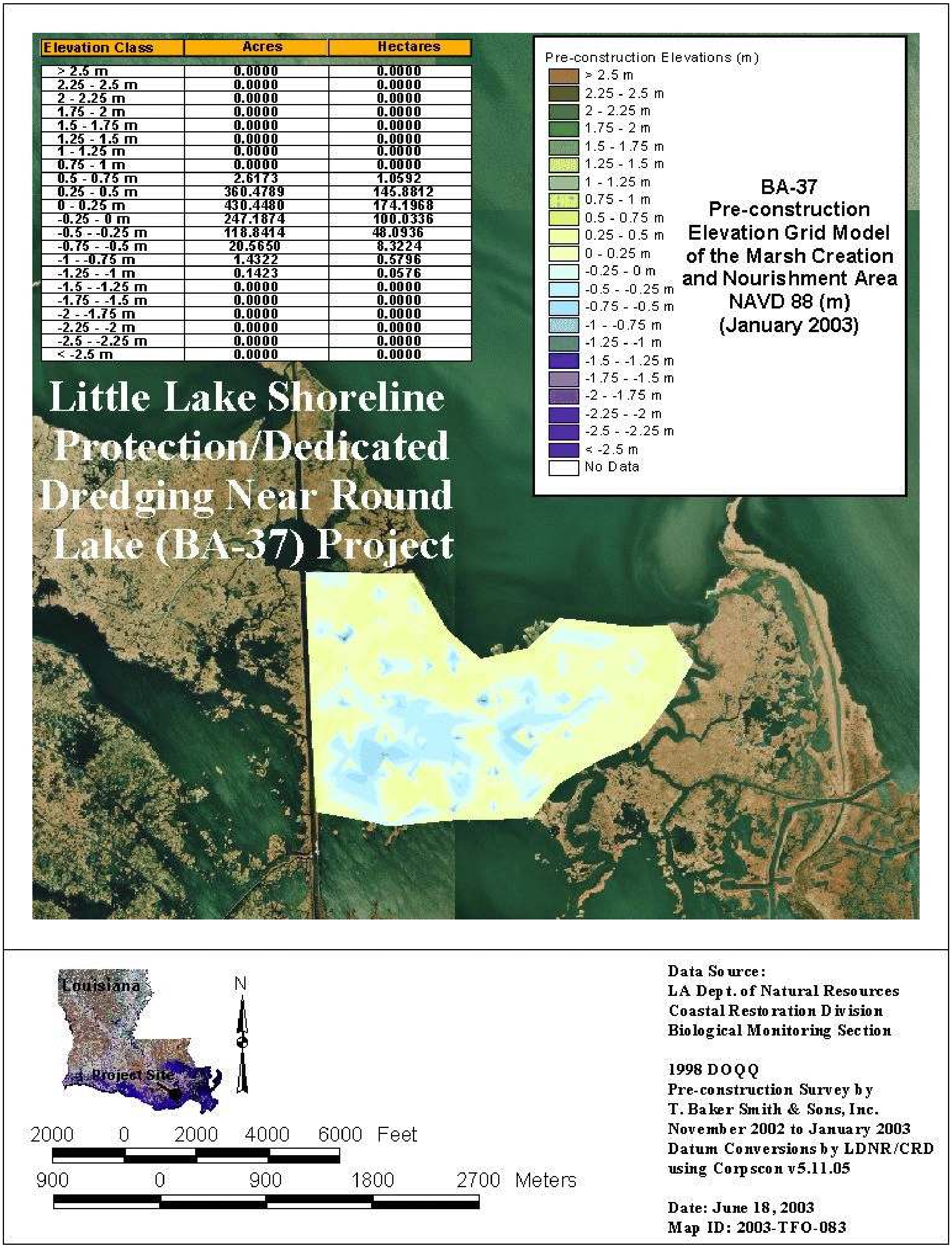


Figure 11. Pre-construction elevations in the marsh creation and nourishment area at the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project.

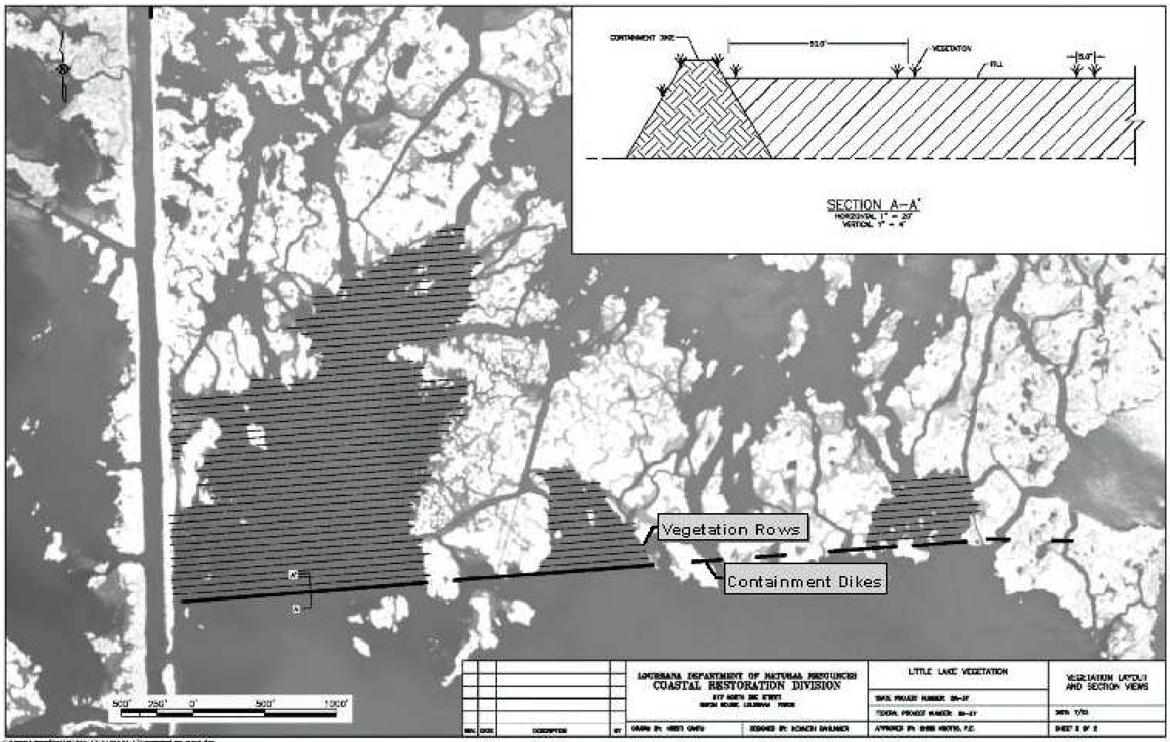


Figure 12. Location of the vegetation plantings on containment dikes and in the marsh creation and nourishment area at the Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) project.

Reference Area:

The importance of using appropriate reference areas cannot be overemphasized. Monitoring on both project and reference areas provides a means to establish performance standards that can compare wetland structure and ecological function, and is therefore the most effective means of assessing project effectiveness (Brinson and Rheinhardt 1996). Coastal marshes are very dynamic in nature. Therefore, reference areas in these environments need to be monitored over time to determine wetland community structure and function (Moy and Levin 1991; Simenstad and Thom 1996; Zelder 1993; Mitsch and Wilson 1996). Soil properties, vegetative community structure, hydrologic regime, and proximity to the project area are the criteria used to evaluate reference areas that could be used as standards to determine wetland structure and function in the created marsh. The Coast-wide Reference Monitoring System (CRMS wetland) was developed by LDNR to facilitate the use of statistically valid comparisons (Steyer et al. 2003). The CRMS wetland is a network of 700 spatially fixed 1 km^2 monitoring stations which are randomly distributed throughout the coastal zone of Louisiana. Of the total, 200 stations will be monitored annually, with approximately one-third of the remaining 500 stations being monitored every year without replacement. Thus each year approximately 367 stations are monitored for land/water ratio, vegetation composition and cover, elevation, duration and frequency of flooding, salinity, sedimentation/erosion, and soil pore water properties. This approach allows sufficient replication to represent the functional variation of the measured response variables (Steyer et al. 2003). The CRMS wetland provides a statistically sound methodological framework for comparisons on two levels. The first involves the evaluation of the effectiveness of CWPPRA projects in comparison to ecologically similar reference sites. The second provides the ability to evaluate temporal changes occurring on a greater spatial level, such as that of hydrologic basins or the Louisiana coastline as a whole.

Monitoring Strategies

The following monitoring elements will provide the information necessary to evaluate the specific goals listed above:

CRMS Strategies

1. Land/Water Ratio- As a critical component of the CRMS wetland methodology, basin-level satellite imagery will be obtained to document marsh to open-water ratios. The imagery will be processed by the National Wetlands Research Center (NWRC) personnel using standard operating procedures documented in Steyer et al. (1995) for determining land-to-water ratios. The imagery will be obtained prior to construction in 2005 and after construction in 2008, 2011, 2014, 2017, 2020, 2023 and 2026.

Supplemental Project-Specific Information

2. Marsh Vegetation Habitat Type- Chabreck and Lindscombe habitat maps will be used as ancillary data to evaluate vegetation habitat changes over time. These habitat maps will be obtained prior to construction in 2005 and after construction in 2010 and 2015.

3. Topography- To estimate elevation changes over time, pre-construction (2003) and as-built (2006) surveys of the marsh creation and nourishment area will be obtained from the project engineer. Elevation and sediment volume analysis will be conducted in accordance with procedures established in Ormsby and Alvi (1999) and Rapp et al. (2001). If additional post-construction topographic surveys are conducted, these data will be incorporated in the elevation and sediment volume analysis.

Anticipated Statistical Analyses and Hypotheses

The following describes hypotheses and associated statistical test, if applicable, used to evaluate each of the quantifiable goals and thus the effectiveness of the project. These are followed by statements of the project goals, and the hypotheses that will be used in the evaluation.

Land/Water Ratio:

Descriptive and summary statistics on historical data (1956, 1978, and 1988) and data from satellite imagery collected during pre- and post-construction will be used, along with GIS interpretations of these data sets, to evaluate marsh to open water ratios.

Goal: Reduce the marsh edge erosion rate along the Little and Round Lake shorelines.

Goal: Maintain 799 acres (323 ha) of emergent marsh at the end of the 20 year project life.

Notes

1.	Planned Implementation:	Start construction -	August 5, 2005
		End construction -	November 16, 2006
2.	NMFS Point of Contact:	Cheryl Brodnax	(225) 578-7923
3.	DNR Project Manager:	Greg Grandy	(225) 342-6412
	DNR Monitoring Manager:	Glen Curole	(985) 447-0995
	DNR RTS Assistant:	Karim Belhadjali	(225) 342-4123

4. Periodic Operations, Maintenance and Monitoring Reports will describe the status and effectiveness of the project. In addition, annual summary data and graphics on surrounding CRMS-*Wetlands* sites will be available.

5. References:

Barras, J.A., P.E. Bourgeois, and L.R. Handley. 1994. Land loss in coastal Louisiana 1956-90. National Biological Survey, National Wetlands Research Center Open File Report 94-01. 4 pp. 10 color plates.

Belhadjali, K. and J. L. Cowan. 2003. Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) Ecological Review. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division. 12 pp.

Brinson, M. M. and R. Rheinhardt. 1996. The Role of Reference Wetlands in the Functional Assessment and Mitigation. Ecological Applications 6: 69-76.

Chabreck, R.H., T. Joanen, and A.W. Palmisano. 1968. Vegetative Type Map of the Louisiana Coastal Marshes. Louisiana Wildlife and Fisheries Commission, U.S. Army Corps of Engineers, Louisiana Cooperative Wildlife Research Unit, and Louisiana State University.

Chabreck, R.H., and G. Linscombe. 1978. Louisiana Coastal Marsh Vegetative Type Map. Louisiana State University and Louisiana Department of Wildlife and Fisheries.

Chabreck, R.H., and G. Linscombe. 1988. Louisiana Coastal Marsh Vegetative Type Map. Louisiana State University and Louisiana Department of Wildlife and Fisheries.

Chabreck, R.H., and G. Linscombe. 1997. Louisiana Coastal Marsh Vegetative Type Map. Louisiana State University and Louisiana Department of Wildlife and Fisheries.

Delaune, R. D, S. R. Pereshki, and W. H. Patrick, Jr. 1993. Response of Coastal Vegetation to Flooding and Salinity: A Case Study in the Rapidly Subsiding Mississippi River Deltaic Plain, USA. Pp. 212-229 in M. B. Jackson and C.R. Black, ed. Interacting Stresses on Plants in a Changing Climate. NATO ASI Series. 1: 1243 pp.

Eustis Engineering Company, Inc. 2003. Geotechnical Investigation State of Louisiana Little Lake Shoreline Protection and Marsh Creation, Lafourche Parish, Louisiana. DNR Contract No. 2503-03-33. State/ Federal Project No. BA-37. Eustis Engineering Project No. 17623. 21 pp. plus appendices.

Gagliano, S. M. and K. M. Wicker. 1989. Processes of Wetland Erosion in the Mississippi River Deltaic Plain. Pp. 28-48 in W.G. Duffy and D. Clark, ed. Marsh Management in Coastal Louisiana: Effects and Issues - Proceedings of a Symposium. U.S. Fish and Wildlife Service and Louisiana Department of Natural Resources. U.S. Fish Wildl. Serv. Biol. Rep. 22: 378 pp.

Mitsch, W. J. and R. F. Wilson. 1996. Improving the Success of Wetland Creation and Restoration with Know-How, Time, and Self-Design. Ecological Applications 6: 77-83.

Moy, L. D. and L. A. Levin. 1991. Are *Spartina* Marshes a Replaceable Resource? A Functional Approach to Evaluation of Marsh Creation Efforts. Estuaries 14: 1-16.

NOAA-NMFS. 2003. Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) Environmental Assessment. U.S. Department of Commerce, National Atmospheric and Oceanic Administration, National Marine Fisheries Service. 33 pp.

Nyman, J. A. , R. H. Chabreck, R. D. Delaune, and W. H. Patrick, Jr. 1993. Submergence, Salt-Water Intrusion and Managed Gulf Coast Marshes. Pp. 1690-1704 in O. T. Margoon et al., ed. Coastal Zone 93: Proceedings of the Eight Symposium on Coastal and Ocean Management, New Orleans, LA.. American Society of Civil Engineers. 3: 3512 pp.

O'Neil, T. 1949. Map of the Southern Part of Louisiana Showing Vegetation Types of the Louisiana Marshes. In The Muskrat in the Louisiana Coastal Marshes. Louisiana Department of Wildlife and Fisheries, New Orleans, LA.

Ormsby, T. and J. Alvi. 1999. Extending ArcView® GIS. ESRI Press, Redlands, Califorina: 527 pp.

Rapp, J. M., M. Fugler, C. K. Armbruster, and N. S. Clark. 2001. Atchafalaya Sediment Delivery (AT-02): Progress Report #1. LDNR/CRD, Baton Rouge. 39 pp.

Sasser, C. E. and D. E. Evers. 1995. Vignette Studies: Local Case Studies of Wetland Loss. Pp. 237-283 in Denise Reed, ed. Status and Trends of Hydrologic Modification, Reduction in Sediment Availability, and Habitat Loss/Modification in the Barataria-Terrebonne Estuarine System. Barataria-Terrebonne National Estuary Program, Thibodaux, LA, 20: 388 pp.

Steyer, G. D., R. C. Raynie, D. L. Stellar, D. Fuller, and E. Swenson. 1995. Quality Management Plan for Coastal Wetlands Planning, Protection, and Restoration Act Monitoring Program. Open-file series no. 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division. 97 pp.

Steyer, G. D., C. E. Sasser, J. M. Visser, E. M. Swenson, J. A. Nyman, and R. C. Raynie. 2003. A Proposed Coast-wide Reference Monitoring System for Evaluating Wetland Restoration Trajectories. Environmental Monitoring and Assessment 81:101-117.

Simenstad, C. A. and R. M. Thom. 1996. The Functional Equivalency Trajectories of the Restored Gog-Le-Hi-Te Estuarine Wetland. Ecological Applications 6: 38-56.

Sweeney, R. 2001. Little Lake Shoreline Protection/Dedicated Dredging Near Round Lake (BA-37) Wetland Value Assessment. 12 pp.

U. S. Soil Conservation Service. 1984. Soil Survey of Lafourche Parish, Louisiana. 228 pp.

Zelder, J.B. 1993. Canopy Architecture of Natural and Planted Cordgrass Marshes:Selecting Habitat Evaluation Criteria. Ecological Applications 3: 123-138.